Impact Of Stone Slurry Powder On Binder &Crumbed Rubber As Limited Substitution On M40 Concrete

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Abstract: The purpose of this project is to find out the strength parameters and durability of concrete. The stone slurry powder (SSP) is a fine dust particle from stone cutting industry which is main reason for environment pollution. Crumb rubber (CR) tire particle which are obtained from waste tire rubber were used for present investigation. In this project the stone slurry powder is used as a replacement of cement at replacement ratio of 10%, 20% 30% & 40%. Crumb rubber of 20mm size is used as fine aggregate at 10% replacement constant at every trial mix. For optimal mix (30% SSP & 10% CR) the workability was good and durability test (Acid Attack Test) was excellent & weight loss was around 0.35%. The strength parameters like compressive strength, split tensile strength and flexural strength test was carried out upto 28 days curing. The strength obtained for split tensile and flexural strength is more than conventional concrete but compressive strength is nearer to the target mean strength as designed. Mix (30% SSP & 10% CR) can be used in construction as alternative to conventional concrete. But we can increase stone slurry powder upto 70% and crumb rubber can be maintained not be more than 10%, use of very fine particle crumb rubber less than 2mm size can enhance the compressive strength.

Keywords: Stone slurry powder, Crumb rubber, Mechanical properties, Acid Attack Test etc.

1. INTRODUCTION

Concrete is an ingredient material used in many constructions that involves like chemical passive material for example aggregate (Fine aggregate & coarse aggregate) which is fused with a cement & convenient water. In specific, lots of materials are used, as replacement materials of buildings, like glass fiber, hollow bricks, and steels, aggregates (fine aggregate and coarse aggregate) & also cement. Continue the same constituents in the construction industry. Limitations of durability, strengths and structural strength of concrete are kind great uses of features in construction trade to do infrastructures, superstructures, roads and many others. Concrete is highly desirable building material which is used as in construction field and has developed very classy, todays because of the equivalent improvement in demand of the construction industry. In the present development, the constant improvement in populations arise end of the result which mechanization and techniques related to waste materials & the rate of ejection of waste material have also improved. Day by day increases, the requirement for construction materials continues to increases. All the concrete materials are developed from the earth's shell. Decreases the natural earth assets, human actions make industrial waste & agricultural waste all over the industries of 2500MTperyear (Internet source,"rjeas.emergingresource.org"). The organization of industrials wastes became a severe problem in the world. So the surveys were advanced in such a way as to reduce these problems & use of waste material in normal concrete. From current investigations, their outcomes are that the waste materials, both organics & inorganic, which produces numerous by-products can be applied to the concrete.

2 OBJECTIVE OF THE PROJECT

To find out the strength parameters of concrete using stone slurry powder as cement replacement and crumb rubber as substitution material for fine aggregate. In this present work, we use the material as partial replacement to cement is stone slurry powder. Replaced the material in the proportion of (10%, 20%, 30%, 40%) up to 40% to total cement content of this work and crumb rubber as part additional material for fine aggregate at 10% constant at every mix.

For the execution of the experimental work, I used a total of four numbers of trail mixes in the proportions of CC, Mix_1, Mix_2, Mix_3, and Mix_4.With the reference of standard values, the results of the tests are compared to conventional concrete and comparisons are drawn in graph. An acid attack test is conducted for concrete Mix_3 to know the durability properties.

3 MATERIALS USED

The use of materials for this experimental work of concrete areas listed in the below points.

1 Cement

Strength accomplishing in concrete the initial material cement is used OPC 53 grade. The CCI 53 grade is collected from nearby accessible cement dealers & all the properties are

2 Coarse Aggregate (20mm)

In this current investigation I used certainly accessible coarse aggregate from stone mining plants which are located very nearby Gulbarga & it has the granular size about 20mm were used in current work. The shape of CA is in Rounded & angular. The CA is tested in KCT ENGINEERING COLLEGE GULBARGA.

3 3 Fine Aggregate

In this current investing we use fine aggregate. Which is available in naturally like (River) sand & it comes under zone-II. The sand is collected from Shahabad which is situated near Gulbarga. The sample is tested in KCT ENGINEERING COLLEGE GULBARGA.

4 SSP (Stone Slurry Powder)

An ongoing survey on the stone cutting industry defines that there exists added than 247 quarries and more than 470 stone cutting plants. These structures use around 0.5 million m^3 of potable water a year and produce between 70, 00,000 and 10, 00,000 tons of sludge as waste. Almeida et al. (2007) described that the world stone production is in authority for producing around one ton stone mud for 2.5 tons of end product. Stone slurry residues contain substantial metals & suspended solids ranging in the choice of 5,000 -

12,000 mg / l, generally consisting of calcium carbonate ($CaCO_3$). The quantity of waste that accumulates in quarries, and in cutting plant & open areas is a creating problems for the stone industry in Palestine. In adding to exhausting mineral properties, it exhibits severe environmental impacts on water, air, soil, landscape, biodiversity, & human communities. In general, the main problems related with quarries and stone manufacture are: great influence on air quality, on groundwater and on surface water; rise in the pH value & the impact of flora, fauna and soil; depletion of huge quantities of fresh water; the elimination of sludge waste decreases the area of fertile lands Dense metal in stone mud are not mixing in water; Suspended fine solids source respiratory problem. The stone slurry powder taken from the R.M.C.Group near Shahabad Cross, Gulbarga.

5 CR (Crumb Rubber)

Crumb rubber (CR) is a produce manufactured by shredding waste a tires of automobiles. Recycling the waste tires & eliminating the steel remains located in steel attached tires produces CR (crumb rubber). Here three mechanical procedures used as to scrap separately these tires to CR. The crack mill, granulator, & micro mill methods. Crumb rubber may also synthetic done by the cryogenations method. This method includes cracking the rubber later falling the temperature with the liquid nitrogen's. Crumb rubber is fine rubber units oscillating in size in0.070-mm - 4.75-mm. in this current work, we use the 2mm size of CR as a partial replacement material for FA. Neoprene Rubber Crumb Rohan Enterprises from Pune.

6 Super plasticizer (SP)

SP is one of the waters reducing agents, it reduces the water requirement for normal mix concrete. SP enhances the workability and in turn strength of concrete. Its pure effect is increased when decreasing the water percentage in mix. The dosage essentially depend on the adoption of the W/C ratio of the concrete mix. In this experiment, we use FOSROC AURAMIX 300+. The dosage of SP is constant for every trail mix. The specific gravity of SP is 1.095 and preserved constantly as 7% for this work.

7 Portable Water

For present investigation work water castoff for mix of the concrete & also used for curing purpose also the usage of water for this work should be free from acidic content.

4 PROCEDURES FOR CONCRETE M40 GRADE MIX

Referring to the codebook IS 10262-2009 mix design is adopted concrete mix to achieve the target strength. Mix designed for M-40 grade mix of concrete. In this experimental work, one conventional mix is used by SSP. River sand (FA) is partially replaced by Crumb Rubber by 10%. SSP is partially substituted to OPC cement with maintaining CR as constant like 10% and SSP is varied from 10% to 40% to normal concrete. The w/c 0.4 selected with different mix and different conventional concrete is made to find and adopt the exact W/C ratio to the concrete work. Also with different mixes of concrete with super plasticizer find out the dosage content of it. FA is replaced with CR maintain this material as constant to FA like 10%. With the help of mix calculation adopting the proper ratio to concrete checking out the fresh state tests and hardened state tests on it also to determining the durability characteristics of the concrete tests were conducted on this concrete that is water absorption test. Test results are equal to conventional concrete. (IS -10262:2009 code book referred for the mix design and selection of w/c ratio).

5 STUDIES OF CONCRETE PROPERTIES WHICH IS IN FRESH STATE

1 Slump Test

(IS 10262-2009 referred for identifying the slump character from the values)

Table 7. Shows the slump values with all mix variations.

Sl. No.	Concrete With Different % Mix Of SSP	Slump Values In (mm)
1	0%	46
2	10%	57
3	20%	61
4	30%	70
5	40%	58

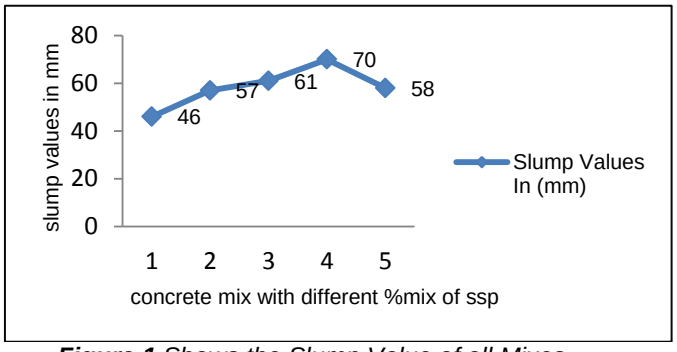

Figure 1.*Shows the Slump Value of all Mixes*

this is the figure pf slump values of different concrete mix with SSP.

2 Compaction Factor

$$Compaction\ Factor = \frac{weight\ of\ partially\ compacted\ concrete}{\text{weight of fully compacted concrete}}$$

(IS 10262-2009 formula taken for calculation of compaction factor and to know the workability of the concrete)

Table 8. Shows Compaction Factor Values of all Mixes.

Sl. No	Adding Up Of SSP In %	Partially Load Of Moderately Compacted Mix (W1) kg	Fully Load Of Entirely Compacted Mix (W2) kg	Compaction Factor Value (W1/W2) –kg
1	0%	14.1	15.6	0.92
2	10%	15.2	16.1	0.94
3	20%	14.8	15.2	0.95
4	30%	14.5	14.8	0.98
5	40%	13.1	14.2	0.91

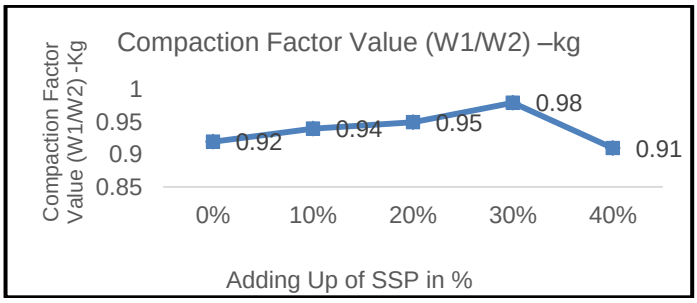

Figure 2. *Shows the Compaction Factor Varies with SSP Mix.*

From the tests (slump test & compaction factor test) result obtained is good workability than the conventional concrete. So workability of mix3(30%SSP,10%CR) is more than the conventional concrete.

6 TESTING OF HARDENED CONCRETE WITH DIFFERENT METHOD'S

Here there are mainly three tests were carried out to determine the hardened things of concrete they are, (IS-516:1959 Code Book to Compare Compressive Strength & Flexural Strength) (IS-5816: 1970 Code Book to Compare Split Tensile Strength).

Table 9.Shows the strength values of all three tests

Sl. no	Material Mixing (SSP, CR) In %	Total Compressive Force (N/mm^2) Curing Days			Total Split Tensile Force (N/mm^2) Curing Days			Total Flexural Force (N/mm^2) Curing Days		
		3	7	28	3	7	28	3	7	28
1	CC(Conventioal Concrete)	22.00	35.06	48.770	1.06	2.43	3.23	1.96	4.23	5.31
2	Mix_1(10%,10%)	22.21	30.66	41.860	1.96	2.28	3.13	2.5	3.70	5.16
3	Mix_2(20%,10%)	23.32	33.176	45.890	2.04	2.65	3.10	2.93	4.10	5.20
4	Mix_3(30%,10%)	23.55	37.210	49.650	2.36	2.92	3.70	3.66	4.93	6.20
5	Mix_4(40%,10%)	21.62	36.166	46.990	2.23	2.69	3.46	3.46	4.56	6.00

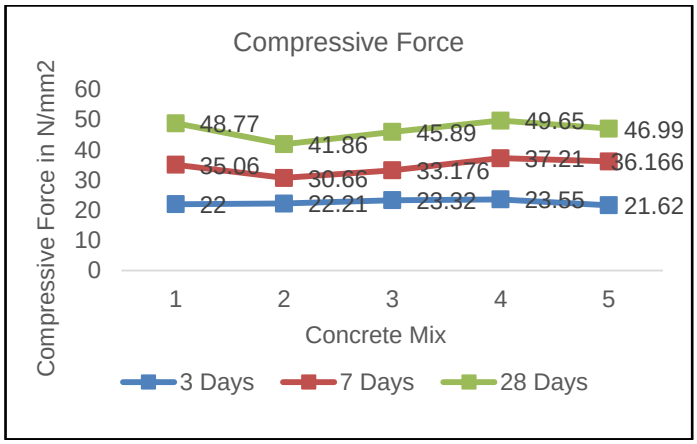

Figure 3.*Shows the 3,7,28 days compressive strength test results variation*

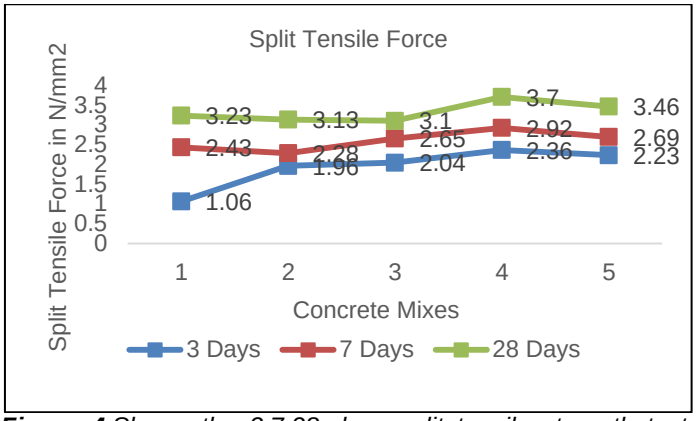

Figure 4*.Shows the 3,7,28 days split tensile strength test results variation*

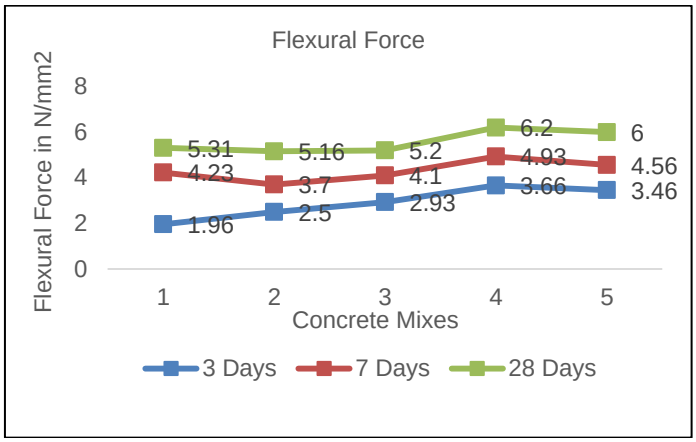

Figure 5*.Shows the 3,7,28 days flexural strength test results variation*

The concrete structure is appraised for the test of the compressive force of ultimate strength concrete for the substitution materials i.e. SSP & CR. The testing is done for cured concrete under 3, 7, 28 days of curing concrete. At every trail mixes of this work, concrete mixes are be tested under compressive force, split tensile force, and flexural strength. In this experimental work, the Compressive force improves with substitution of SSP to OPC cement. The ultimate strength archives in this work of concrete have SSP i.e.30% and CR i.e. 10% the strength is almost nearer as compared to normal concrete (CC). It also increases the strength i.e. split tensile strength in this present work of concrete also archives the ultimate strength in this work of Mix_3 i.e. 30% of SSP and 10% CR improves the strength is about 0.55% as compared to normal concrete i.e. CC. It also increases the strength of concrete i.e. Flexural strength in this present work of concrete also archives the ultimate strength in this work of Mix_3 i.e. 30% of SSP and 10% CR improves the strength is about 1.5% as compared to normal concrete i.e. CC. Finally, the investigation work has explained the OPC cement by SSP (30%), natural FA by CR (10%) got optimum ultimate results of the concrete. Also, it improves the strength & durability property of special concrete.

7 DURABILITY TEST

Acid Attack Test (Hydrochloric Acid):
Concrete cubes the size is like 150mmX150mmX150mm are prepared only for them to study the durability property of concrete grade is about M40 in this present investigation we use 4% of hydrochloric acid (HCL) it is a strenuous solution is used & cubes are kept for 28 days curing. The M40 grade concrete contains three numbers of concrete cubes of the proportion of Mix_3(SSP 30%, CR 10%) this mix is associated with Normal Concrete. To analyses the durability properties we conduct the test is the weight loss test. The concrete cubes are exposed to 4% concentrated hydrochloric acid (HCL) strenuous solutions. & also conclude the percentage of WL (weight loss) in SSP involved concrete. (Ref. IS 10262-2009) for the different types of durability tests.

Table 10. Displays the WL (Weight Loss) in Cubes Testing Later 28 Days with Acid Effects

Sl. No	Mixes	Weight Of Sample Previously 28days Soaking In HCL (W_1 gms)	Weight Of Sample Later 28 Days Soaking In HCL (W_2 gms)	WL (Weight Loss) In Sample (%)
1	CC(Conventional Concrete)	8.650	8.300	0.35
2		8.888	8.56	0.328
3		8.857	8.63	0.227
4	Optimal Mix_3 (SSP30%, CR 10%)	8.956	9.276	0.32
5		9.655	9.236	0.419
6		9.443	9.110	0.333

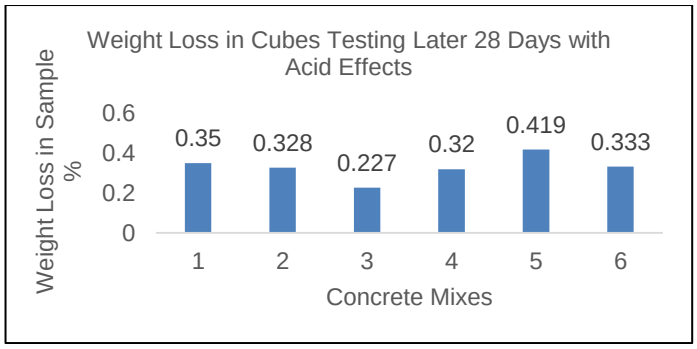

Figure 6.*Displays Percentage WL (Weight Loss) in Sample with Acid Attack*

8 CONCLUSION

Workability property in fresh concrete is high rapidly when adding SSP to cement. With the addition of SSP with 30% to cement (OPC), the strength is achieving nearer of M 40 grade of concrete with improve the mental percentage of 10%, 20%, 30%, 40% also CR is constantly maintained 10% to natural FA. With replacing SSP and CR may be used in the construction industry like 30% of SSP to OPC cement and 10% of CR to natural FA provides ultimate strength. In this experimental work SSP is varied here is an improvementin strength of the concrete. The optimum results are found in this present work by replacing SSP to OPC cement and CR to natural FA i.e. 30%, 10% have ultimate strength. The percentage of loss of weight of SSP is more less as associated to Conventional concrete i.e. Mix_3 (30% SSP, 10% CR)the total loss of weight in normal concrete is less as compared to normal concrete i.e. Mix_3(30% SSP, 10% CR) the average weight loss in CC is about 0.301% & Mix_3 have loss is about 0.35%. As we decrease the crumb rubber percentage replacement there may be an increase in compressive strength but the stone slurry powder is the main reason in having the strength. After the acid attack test when we again did the compressive strength it was more as compared to special concrete.

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